

REMARKS

Favorable reconsideration of this application is respectfully requested.

Claims 138-175 and 177-295 are present in this application. Claim 176 is canceled as claim 168 recites that the cleaning step is a dry process. Claims 177, 178 and 235 are amended. New claims 260-295 are added. New claims 260-282 contain language which is recited in claims 237-259, respectively, and each of the groups of claims 283-286, 287-290 and 291-294 contains language which is recited in claims 148 and 139-141, respectively. Claim 295 contains language which is recited in claim 236. No question of introduction of new matter is believed to be raised by new claims 260-295.

Claims 235, 237-239, 242, 247, 251, 255 and 259 are rejected under 35 USC §102(b) over US 5,503,704 (Bower et al.). Claims 138-234 are allowed and claims 236, 240, 241, 243, 246, 248-250, 252-254 and 256-258 were found to be allowable if rewritten into independent form.

First, the Applicants greatly appreciate confirming the allowance of claims 138-234 and finding claims 236, 240, 241, 243, 246, 248-250, 252-254 and 256-258 to recite patentable subject matter. Claim 236 is rewritten into independent form. Claim 236, and claims 260-286 dependent therefrom, are believed to be in condition for allowance. Claims 287-290 dependent from allowed claim 186 are also believed to be in condition for allowance.

It is noted that the status of claims 244 and 245 is not mentioned in the Office Action. It is believed that these claims are allowable.

In the method of claim 235, a first surface of a first element is exposed a plasma, and the first surface is cleaned and terminated after the plasma exposure. The first surface is bonded to a second surface of a second element after the terminating step. Such a method is clearly not disclosed by Bower et al.

Bower et al does not contain any disclosure or suggestion of the method of claim 235 which recites “cleaning said first surface after exposure to said plasma” and “terminating said first surface with a chemical species after exposure to said plasma.” As shown in figure 1 of Bower et al., the ammonia plasma activation in either step 40a or 40b occurs prior to bonding step 45. Further, the cleaning steps 15a and 15b occur prior to the respective plasma activation steps 40a and 40b. The Office Action argues that ammonia plasma activation occurs prior to cleaning and terminating. However, Bower et al does not disclose or suggest such order, and, in fact, only teaches that plasma activation occurs immediately before bonding.

As explained in the summary of the invention in column 2 and in the abstract, the process disclosed in Bower et al is designed to render a material surface hydrophilic and reactive, and the surface is then direct bonded to a second surface (preferably also hydrophilic and reactive). Turning to column 5, lines 12-22, the material undergoes ammonia plasma activation where “[a]t the end this step, the material surface will be both hydrophilic and reactive for low temperature direct bonding.” This is illustrated in step 40a and the material surface is then brought in to physical contact with a second hydrophilic and reactive surface in step 45 to form an initial bond. The base bath, acid bath and RCA clean occur prior to plasma activation, as clearly shown in Fig. 1.

Lines 23-25 of column 5 state that “the material surface is then brought into physical contact with” a second surface 45. There is no mention of any cleaning or terminating after the plasma activation, and these lines clearly show that bonding is the next step after plasma activation.

As for terminating, the Office Action refers to the abstract and column 5, lines 12-22 to argue that Bower et al. discloses “terminating...by immersing in an ammonia-based solution.” This portion of Bower et al. refers to the plasma activation step 40a or 40b. Claim

235 recites terminating after plasma exposure. Clearly, the terminating step of claim 235 is not disclosed in Bower et al.

The Office Action also argues, that column 4, lines 45-67 and the abstract disclose cleaning the surface after exposure to the plasma by removing contaminants from the surface. Column 4 lines 45-67 describe step 15a where the surface is cleaned. As shown in figure 1, step 15a occurs prior to either of steps 40a or 40b. Column 5 beginning at line 1 also describes how steps 40a and 40b occur after steps 15a or 15b. The abstract contains no disclosure or suggestion of cleaning, or any disclosure or suggestion of when a cleaning step should take place. Thus, the abstract and column 4, lines 45-67 do not describe or suggest a process where cleaning the surface occurs after exposure to plasma but in fact confirms that the opposite is true, i.e., that cleaning occurs prior to exposure to plasma.

It is clear that Bower et al. does not disclose the method of claim 235 as there is no disclosure of a process where “cleaning said first surface after exposure to said plasma” and “terminating said first surface with a chemical species after exposure to said plasma” take place. Withdrawal of the rejection of claim 235 based upon Bower et al. is respectfully requested.

It is respectfully submitted that the present application is in condition for allowance
and a favorable decision to that effect is respectfully requested.

Respectfully submitted,

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